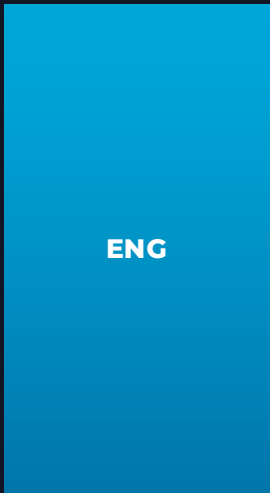




NEUROCLE

DEEP LEARNING VISION SOFTWARE

MAKING
DEEP LEARNING
VISION TECHNOLOGY
MORE ACCESSIBLE



ENG

Neurocle proposes the most innovative and efficient auto deep learning vision inspection solutions, empowering users to create top-tier models efficiently, without significant resource investment.

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04 Introduction to Neurocle

Product & Models

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- 07 Deep learning vision models

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The next level of deep learning vision inspection

Our Company

With the vision of ‘making deep learning vision technology more accessible’, Neurocle is developing an innovative vision inspection software ecosystem with its advanced technology and strong R&D team.

2024



Won the Innovators Awards for four consecutive years (2021-2024)



Selected for the Emerging AI+X Top 100 for two consecutive years (2023-2024)

2023



Won the AI Korea Grand Prize (Minister of SMEs and Startups Award)



Named as the Top in Venture Company in R&D and job creation

2022



Won the K-Startup Challenge Excellence Award



Selected for the Cowen Startup Challenge Top 10 Finalist

2021



Won the Korea ImpaCT-ech Grand Prize



Selected as Gartner Cool Vendor in AI for Computer Vision

Our Technology

Deep Learning Vision Technology

Our deep learning vision software integrates deep learning and computer vision technologies within the framework of artificial intelligence. The models generated using this technology resemble the functionality of the human brain.

Vision Inspection Solution

Deep learning technology enables vision models to conduct high-quality inspections. Among systems utilizing this technology, Neurocle excels by both creating and implementing these advanced models.

Neurocle machine vision ecosystem

Best Partners

We are proud to collaborate with leading machine builders, and our software is trusted by numerous prestigious global companies.



Neurocle's Coverage

Neurocle provides a total solution for vision inspection in collaboration with top industry partners both domestically and internationally.

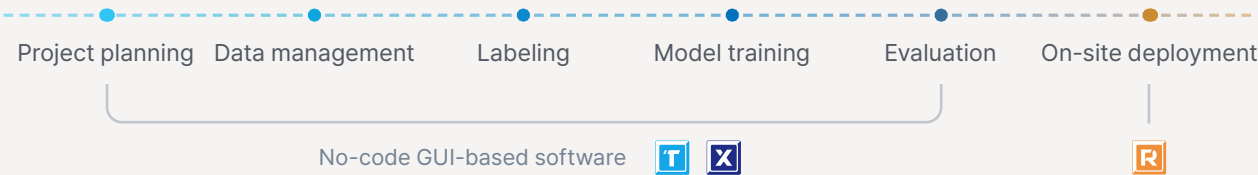
29+

Belgium, Bulgaria, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Switzerland, Turkey

Chile, Costa Rica, Mexico, United States

China, India, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand, Vietnam

Deep learning vision software: From model training to deployment



Train



NEURO-T

Auto Deep Learning Vision Software

Training Method
Train models with optimized algorithms

The algorithm automatically selects the optimal model architecture and hyperparameters to achieve the best performance.

Recommended for
Industry professionals without deep learning expertise

Users can generate models without programming knowledge and in just a few clicks.



NEURO-X

Deep Learning Vision Software for Experts

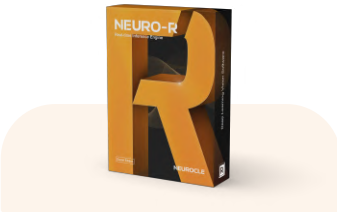
Training Method
Train models with customized hyperparameters

The software offers a range of adjustable parameters to directly optimize model performance.

Recommended for
Deep learning experts looking to run different model evaluations

Users can have full control over hyperparameter settings to refine their own models.

Inference



NEURO-R

Runtime Software Library (Runtime API)

Feature
Runtime API that integrates with equipment and systems

The software enables real-time images and video inspection from connected cameras.

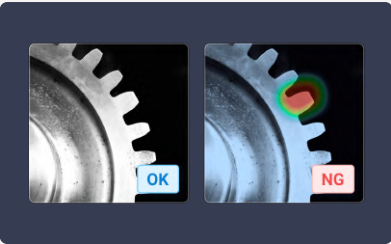
Recommended for
Manufacturing sites for real-time inspection

Users can easily deploy models generated in Neuro-T and Neuro-X to manufacturing settings.

* Supported programming languages : C++, C#, Python

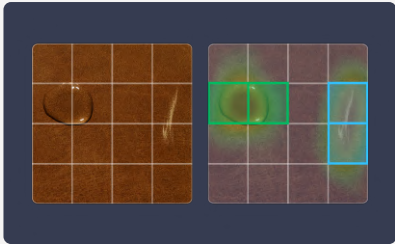
9 types of deep learning vision models

Supervised models



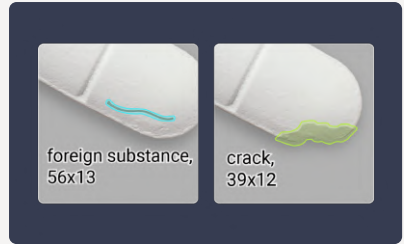
01 Classification

Classifies images to multiple defect categories (an image can contain only one defect)



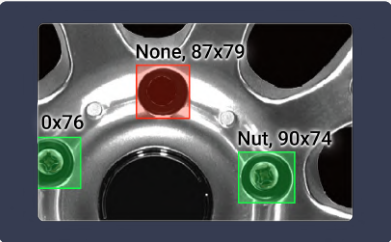
02 Patch Classification

Classifies high-resolution images by dividing them into small patches (an image can contain multiple defects)



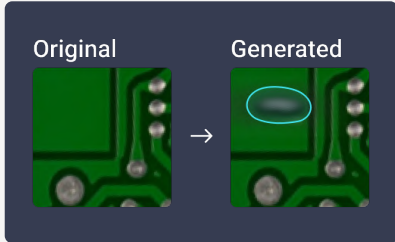
03 Segmentation

Detects the precise shape and location of defects at the pixel level (an image can contain multiple defects)



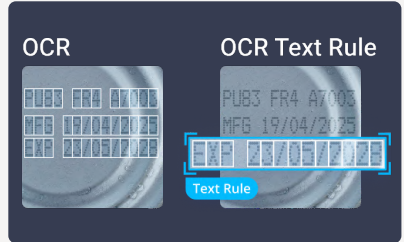
04 Object Detection

Recognizes the number of objects and identifies their locations within the image



05 GAN (Defect Generator)

Generates artificial defect images that resemble real defects



06 OCR / OCR Text Rule

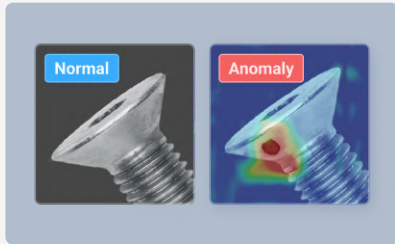
Recognizes text within an image / Applies customized rules to OCR model

Unsupervised models



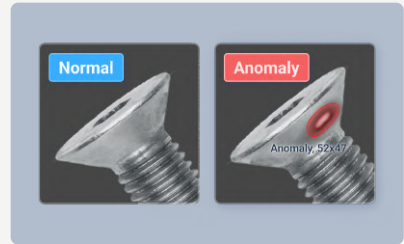
07 Rotation

Automatically rotates original images to the correct orientation



08 Anomaly Classification

Provides binary* classification in the form of a heatmap, trained solely on normal images (*Normal / Anomaly)



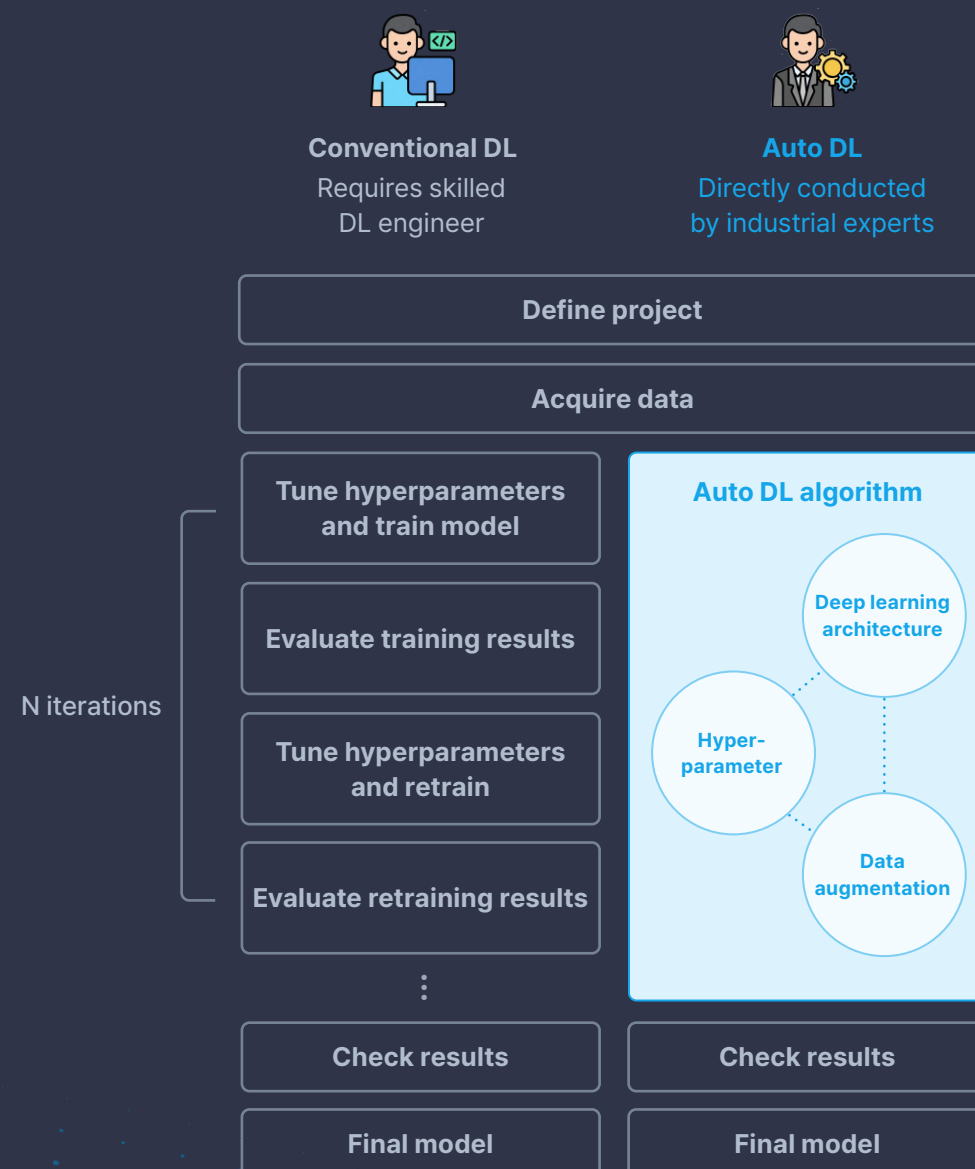
09 Anomaly Segmentation

Detects defective areas at the pixel level, trained only on normal images

Train high-performance models with Auto Deep Learning Algorithm

Our **Auto Deep Learning Algorithm** automatically optimizes model architectures and hyperparameters to create high-performance vision inspection models.

Traditionally, this process required continuous retraining by skilled engineers to meet the performance standards. Our technology simplifies this process, enabling anyone, regardless of their deep learning expertise, to build a high-performance model with a single click.

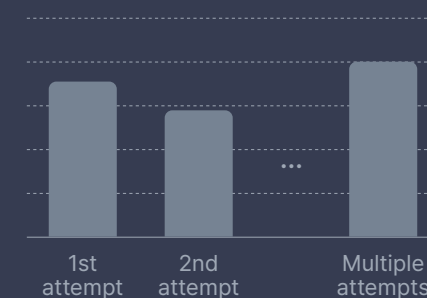


Maximize performance while minimizing costs

Benefit 1

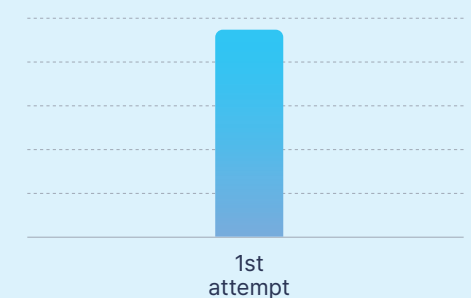
Achieve consistent accuracy, even without deep learning expertise

Conventional DL vision inspection



DL engineers often required multiple attempts to achieve the desired performance.

Auto DL vision inspection



Non-DL quality management team members achieved target performance on the **first attempt**.

*Based on chip breaker defect detection project

Benefit 2

Automate tasks to reduce human efforts and save time

Conventional DL vision inspection



- Involves multiple cycles of training, evaluation, and retraining
- Requires high demand for skilled deep learning engineers

Auto DL vision inspection



- Achieves optimal models with minimal iterations
- Any industry expert without full knowledge can manage the entire process independently

*Based on Company B's film inspection project, achieving 98% inspection accuracy



Discover our key features to overcome vision inspection challenges

With the Auto Deep Learning Algorithm, industry experts can now create models independently. However, creating vision models for inspection can still present various challenges.

Neurocle provides essential features to overcome these challenges and ensure successful vision inspections.

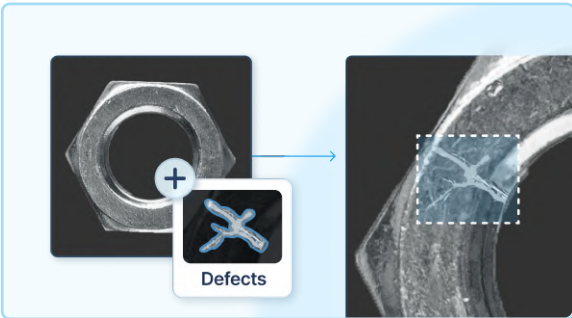
Neurocle’s four key strategies to overcome AI project challenges

01 Collecting high quality data Models improve by reducing the gap between predictions and answers. For this, a large dataset with diverse and relevant characteristics is required.	Challenge Since manufacturing industries often have low defect rates, securing a sufficient amount of data can be difficult.	Our Solution Our artificial defect generation model and unsupervised models enable effective training even when sufficient data is not available.	12p
02 Labeling data accurately Labeling is feeding the model the correct answers. Therefore, consistent and accurate labeling is essential for effective model training.	Challenge Labeling involves detailed manual work, making it time-consuming and labor-intensive.	Our Solution Our AI-assisted features facilitate smart and automated labeling through simple actions like clicking, dragging, and keyword input.	13p
03 Choosing optimal hyperparameters To enhance model performance, it is essential to identify and validate the optimal combination of hyperparameters.	Challenge Varying levels of deep learning knowledge among team members can lead to inconsistency and underperformance.	Our Solution We automatically select the best hyperparameter combinations for all types of projects, ensuring consistent and optimal performance.	14p
04 Deploy models suitable to the environment To interpret images and videos in real-time, fast inference speed is essential.	Challenge Developing inspection models with suitable speeds for manufacturing processes can lead to inefficiencies and delays.	Our Solution Our post-training methods and patch training techniques ensure optimal inspection speeds across various production environments.	15p

Working with small datasets

Overcome data scarcity issues, especially in manufacturing where collecting training data is challenging.

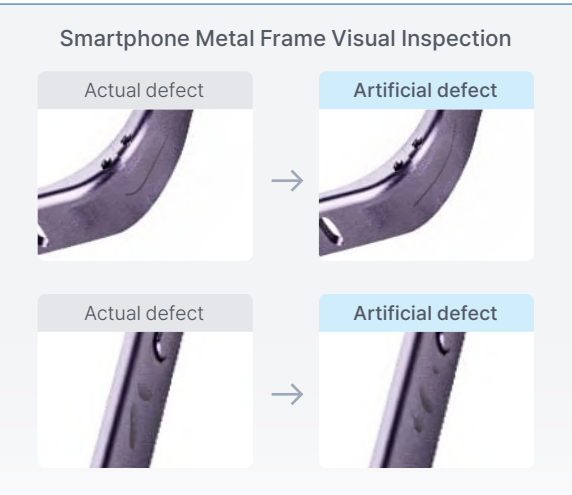
Artificial defect generator GAN model (Defect generator)



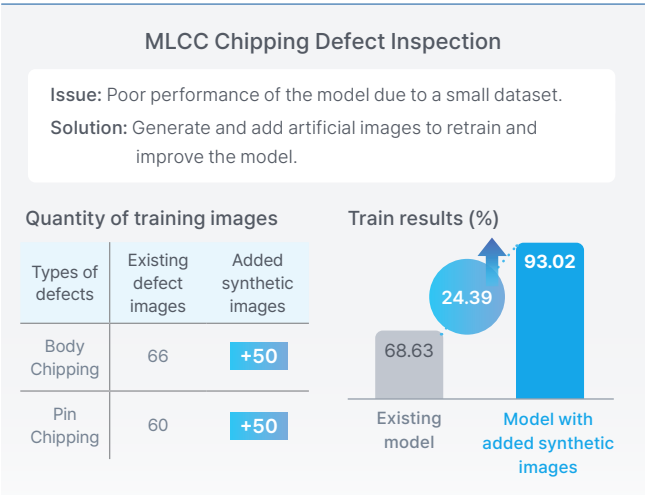
The GAN model addresses the issue of defect data shortage by generating artificial defect images (synthetic data) that closely mimic real defects.

The high similarity between the generated and actual defect images significantly improves the model's accuracy and effectiveness in identifying defects.

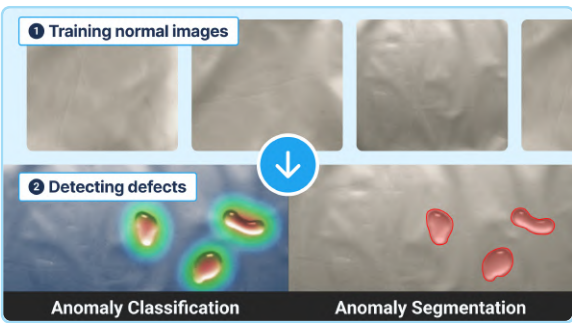
Synthetic images generated by the GAN model



Performance comparison



Unsupervised model training with only normal data Anomaly Classification & Anomaly Segmentation model



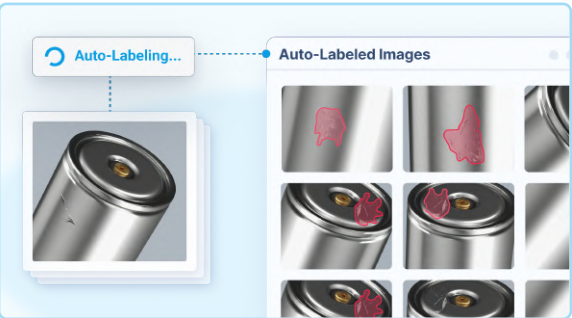
Unsupervised models can be trained solely on normal images, unlike supervised methods that rely on labeled data for model creation.

Neurocle provides two unsupervised models that determine normal and anomaly using the latest unsupervised learning techniques.

Automating labeling with AI tools

Minimize the need for intensive manual resources with our smart AI-assisted labeling tools, boosting both productivity and accuracy.

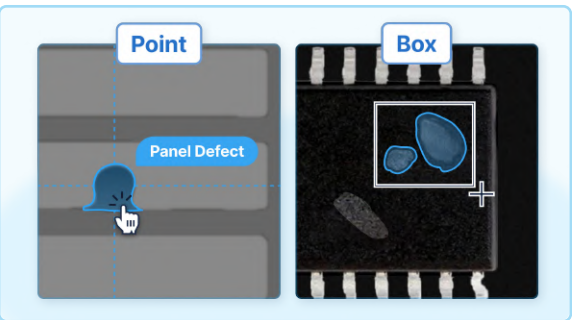
Automatic labeling feature for large datasets Auto-Labeling



Labels are automatically recommended after the user labels a small number of images. The initial labeled images set the standard, reducing labeling effort while ensuring accuracy.

Available Models	All models in Neuro-T
Labeling Criteria	Pre-defined range by user

Polygon labeling with just one click and drag Auto-Selector

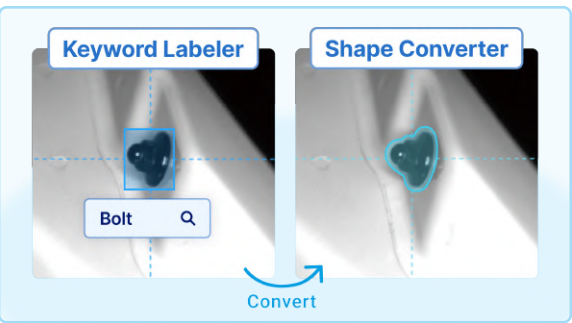


By clicking or dragging to select areas for labeling, our AI detects similar characteristics and identifies related objects.

You can easily add or remove labeling areas with a single click, ensuring accurate labeling in the shortest time possible and significantly reducing manual effort.

Available Models	Segmentation, Anomaly Segmentation, GAN
Labeling Criteria	Feature based

Labeling by entering simple keywords Keyword Labeler & Shape Converter



Keyword Labeler

Simply enter keywords, and the AI will label boxes around the areas in the image that match the keywords.

Available Models	Object Detection, Segmentation, Anomaly Segmentation, GAN
Labeling Criteria	Keyword based

Shape Converter

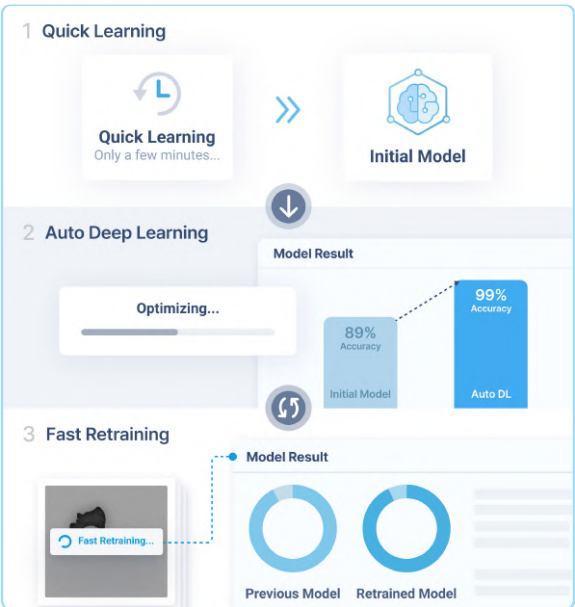
Convert box labels into shapes that fit the objects with a single click.

Exploring single and multi-model workflows

Use our deep learning model training techniques **to achieve optimal inspection performance** in a single model. Also explore the step-by-step useful features **to manage complex projects** that require multiple models.

Train models and maximize performance

Single workflows



Quick Learning

Quickly assess model performance and reduce trial and error for initial training.

Auto Deep Learning

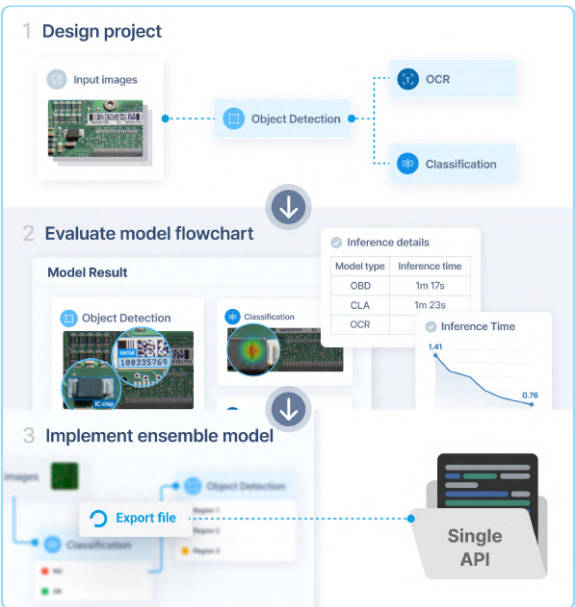
Automatically find the best model structure and hyperparameters for optimal performance, ensuring consistent accuracy with minimal manual intervention.

Fast Retraining

Rapidly update models by adding images containing new defects within the same inspected item.

Design and build ensemble models for complex tasks

Multi-model workflows



Flowchart

Connect multiple deep learning models and design complex inspection projects with intuitive flowcharts.

Inference Center

Predict and validate the performance of flowchart models before deployment. This step ensures effective deployment during the proof of concept (POC) phase.

Multi-Model Export

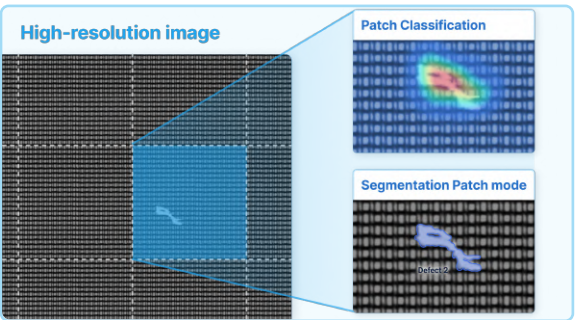
Export the final flowchart model created in the Inference Center as a single file and call it with a single API. This significantly reduces the programming resources needed for multi-model deployment.

Applying methods for diverse scenarios

Detecting tiny defects in high-resolution image data without losing information and conducting rapid real-time inspections are crucial. Neurocle offers **comprehensive training methods tailored to all user environments**.

For high-resolution images containing tiny defects

Patch-based training



Patch Classification Model

High-resolution images are divided into multiple patches for training. This technique helps to identify and distinguish between normal and defective areas within images.

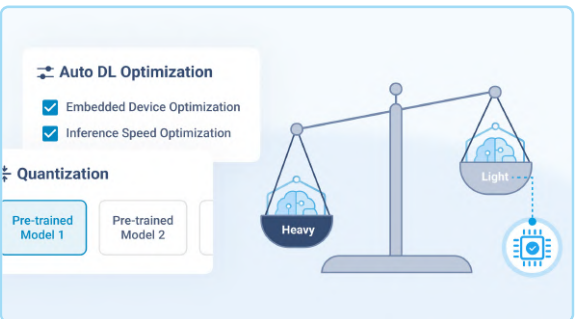
Segmentation Model Patch Mode

During segmentation model training, high-resolution images are split into multiple patches.

These techniques minimize missed defects and ensure precise inspection results.

For fast inference speed

Lightweight models



Optimize with Auto Deep Learning

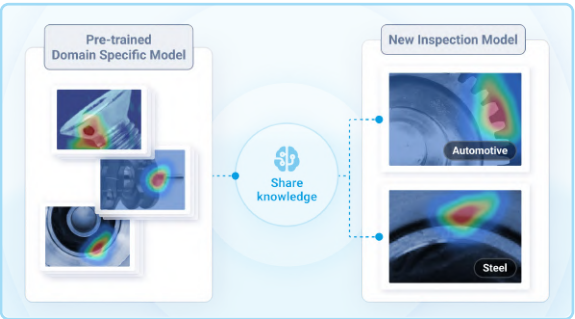
Auto DL training offers optimization options for embedded devices, enabling the creation of models optimized for lightweight devices and improving inference speed.

Post-Training with Quantization

Simplify model operations to reduce the floating point precision of the weights while maintaining high accuracy and speed.

For generating domain-specific models

Transfer learning



Transfer Learning

Transfer learning enables the reuse of pre-trained models for different inspection tasks in similar contexts. This method is recommended when there is sufficient training data available. Once the pre-trained model achieves satisfactory performance, it can be continuously refined and applied to various inspection scenarios.

Inspection solution for all applications across different industries

Use cases by industry

Electronics



Accurately detect defects in small electronic components.

Example

- LED panel inspection
- Soldering bubble detection in PCB board
- Surface inspection for FPCB / MLCC
- Speaker mesh inspection

Battery

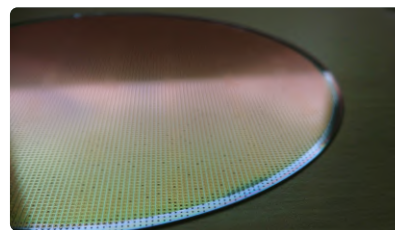


Improve battery yield with precise detection.

Example

- Pouch type battery inspection
- Cylindrical battery cap inspection
- Battery X-ray inspection
- Battery CT inspection

Semiconductor



Accurately recognize irregular defects, replacing visual AOI inspections.

Example

- Wafer notch detection
- Wafer surface inspection
- Wire bond defect inspection
- Integrated circuit leads inspection

Display



Improve display quality through precise panel inspection.

Example

- Bear glass inspection
- OLED mask inspection
- Pattern defect inspection
- Panel damage inspection

Automotive



Enhance production speed which has been automated early on.

Example

- Assembly detection
- Automotive parts and tire inspection
- VIN Number recognition
- Sunroof primer recognition

Metal



Detect machining and welding that are hard to inspect with the naked eye.

Example

- Steel surface inspection
- Press products surface detection
- Steel plates edge detection in rolling process
- Color-coated steel plates inspection

Pharmaceutical



Minimize undetected rates in pharmaceutical industries with strict regulations.

Example

- Pill surface defect inspection
- Medical kit inspection
- Syringe rubber parts defect inspection
- Catheter laser punching detection

Bio & Healthcare



Detect anomalies that are difficult to identify with the naked eye.

Example

- Number of microorganism detection
- Cell detection inside of organs
- Virus infection classification
- Contact lens inspection

Food & Beverage



Provide fresh products to consumers by detecting contaminants.

Example

- Ramen quality classification
- Dumpling number counting
- Tofu contaminant detection
- Beverage foreign object detection

Packaging



Ensure best packaging quality through checking the package condition.

Example

- Glass bottle exterior defect inspection
- Package sealing detection
- Label alignment inspection
- Container printing defect inspection

Logistics



Maximize distribution speed by automating goods sorting and label tracking.

Example

- Container text identification
- Invoice identification and product classification
- Pallet damage classification
- Conveyor belt inspection

Agriculture



Improve yield and quality by establishing personalized management.

Example

- Crop disease infection classification
- Ripeness classification
- Animals abnormalities detection
- Forest damage and fire detection

Choose a lineup that works with you

Neuro-T Essential

Compact essential features
for vision inspection

Support for Auto Deep Learning training

6 different deep learning models*

AI-assisted Labeling

Pre-trained OCR

Neuro-T Pro

All features included
for optimal model performance

Support for Auto Deep Learning training

9 different deep learning models*

Inference Center, Generation Center

Multi-model Export

* Neuro-T Pro includes all features of Neuro-T Essential.

* Deep learning models: (Essential) Classification, Segmentation, Object Detection, OCR, Rotation, Anomaly Classification
(Pro) Includes all Essential models plus Patch Classification, GAN, Anomaly Segmentation

License details

Product	Lineup	License	Account	GPU(Max)
Neuro-T	Essential	Basic	1	1
	Pro	Standard	3	2
		Team*	5	4
Neuro-X	Essential	Basic	1	1
	Pro	Standard	3	2
		Team*	5	4
Neuro-R	Embedded	Embedded	N/A	1
	PC	Single		1
		Double		2
		Multi		4

* If you wish to use licenses higher than Team (more than 6 accounts, more than 5 GPUs), please contact us.

Available support

When purchasing a major version, all minor version updates are supported until the next major version launch.

Version 4.4 Requirements

Product	Category		Minimum	Recommended
Neuro-T Neuro-X	Server	OS	Windows 10 64-bit (Build 17763 or higher), Windows 11 64-bit	
		CPU	Core : 4 Thread : 6	Single GPU : i7, Ultra 7 Multi GPU : i9, Ultra 9
		RAM	32GB (2x larger than GPU Memory)	64GB
		GPU	NVIDIA RTX 4070 (CUDA Compute Capability: 7.0)	NVIDIA RTX 5080 NVIDIA RTX 5090 NVIDIA RTX A5000
	Client	Browser	Chrome (recommended), Microsoft Edge	
Neuro-R ¹	PC	OS ²		Windows 10 64-bit (Build 17763 or higher), Windows 11 64-bit Linux Ubuntu 20.04, 22.04
		Processor (Choose 1)	CPU	Intel Core i3 AMD Ryzen 3
			GPU	NVIDIA RTX 4060 NVIDIA RTX A3000 (CUDA Compute Capability: 7.5)
			OpenVINO	Intel Core 6th Generation
			DirectML	AMD Radeon RX 6600 Intel Arc A750
		Development ³ Environment		Visual Studio 2019
	Embedded	Device / OS ⁴		Jetson AGX Orin, Jetson Orin NX Series / Jetpack v6.1 (Linux Ubuntu 22.04 ARM64) Jetson AGX Xavier, Jetson Xavier NX Series / Jetpack v5.1.2, v5.1.5 (Linux Ubuntu 20.04 ARM64) LattePanda 3 Delta, LattePanda Mu / Windows 11

¹ Supports C++, C#, and Python (versions 3.9 to 3.12) as programming languages.

² OpenVINO and DirectML are supported only on Windows. DirectML requires Windows 10 64-bit (build 19041 or later).

³ Visual Studio requires the v142 toolset and Windows SDK version 10.0.19041.0 or later.

⁴ The supported Jetpack version varies depending on the Neuro-R version.
Neuro-R v4.4 supports Jetpack v6.1, v4.3.2 supports Jetpack v5.1.5, and v3.2.0~v4.3.1 support Jetpack v5.1.2.

Frequently asked questions

Q1 What image formats are supported and what is the smallest detectable object size?

Our software supports .jpg, .png, .bmp, .tif (.tiff), and .dcm (.dicom) formats.
Objects as small as 3×3 pixels can be detected.

Q2 Can I import existing label information?

Neuro-T and Neuro-X support the Label Import feature, allowing you to import label information obtained from other platforms or systems. You can import labels in JSON format and masks in .png, .jpg, or .bmp formats.



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